

# 海外のスーパーコンピューティングの状況

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教授

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「これからのスーパーコンピューティング技術の展開を考える」

シンポジウム

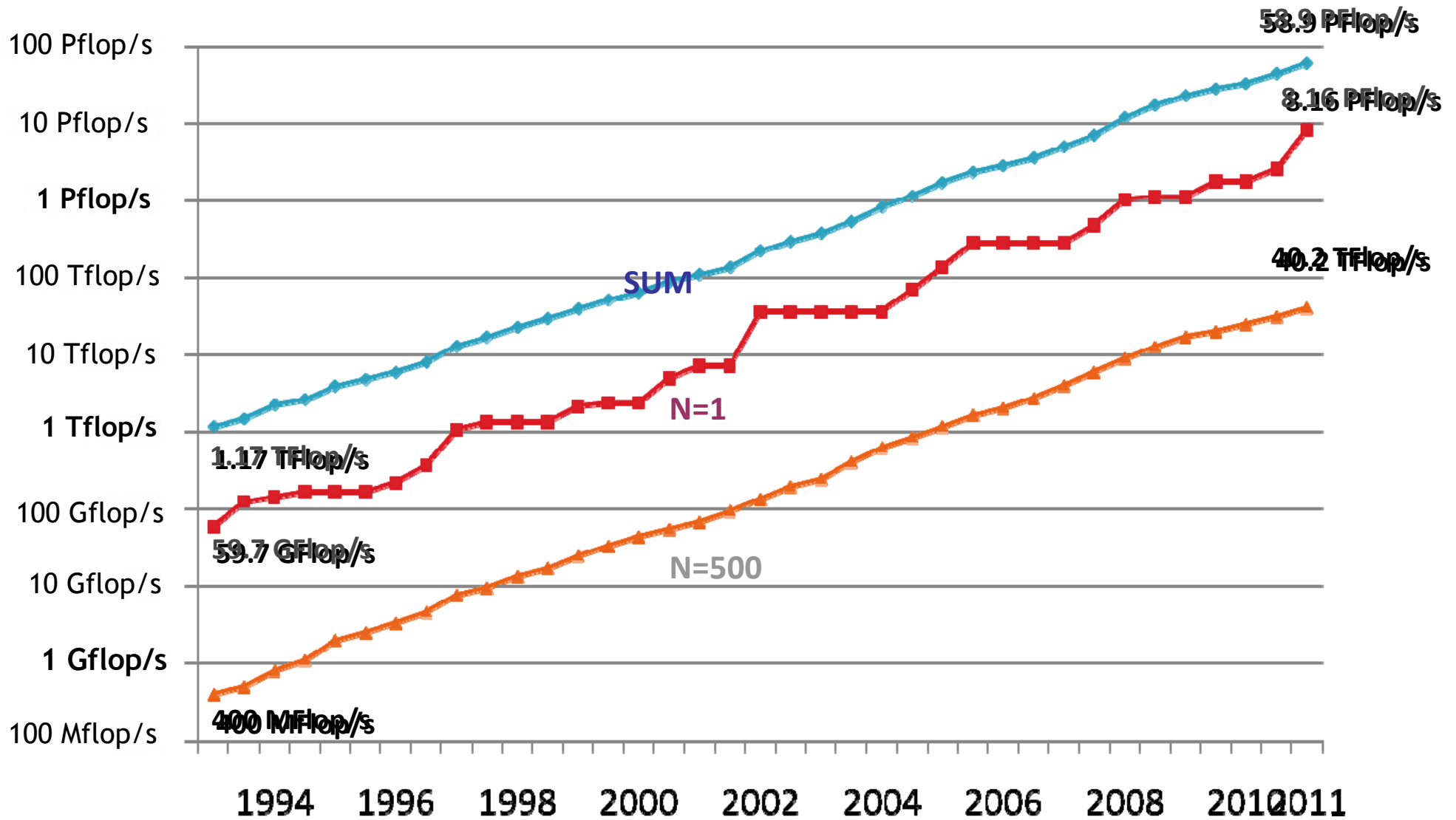
2011年6月27-28日

(Some of the slides courtesy of Erich Stroheimer@LBL,  
Thomas Sterling@LSU, Rick Stevens & Peter Beckman  
Thomas Lippert@Julich SC, Takayuki Aoki @ Tokyo Tech.)

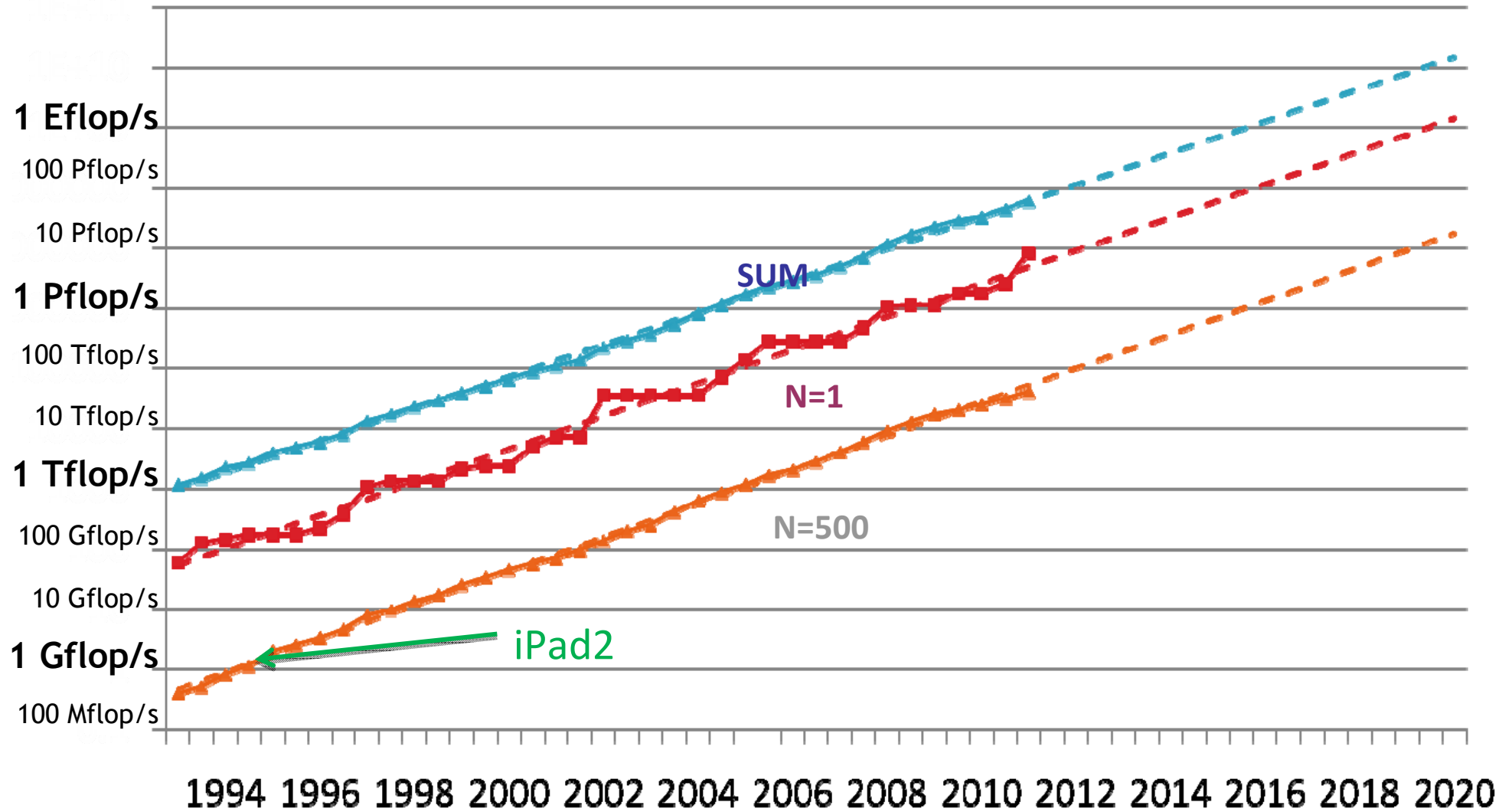
# 37<sup>th</sup> List: The TOP10

Rank	Site	Manufacturer	Computer	Country	Cores	Rmax [Pflops]	Power [MW]
1	RIKEN Advanced Institute for Computational Science	Fujitsu	<b>K Computer</b> SPARC64 VIIIfx 2.0GHz, Tofu Interconnect	Japan	548,352	8.162	9.90
2	National SuperComputer Center in Tianjin	NUDT	<b>Tianhe-1A</b> NUDT TH MPP, Xeon 6C, NVidia, FT-1000 8C	China	186,368	2.566	4.04
3	Oak Ridge National Laboratory	Cray	<b>Jaguar</b> Cray XT5, HC 2.6 GHz	USA	224,162	1.759	6.95
4	National Supercomputing Centre in Shenzhen	Dawning	<b>Nebulae</b> TC3600 Blade, Intel X5650, NVidia Tesla C2050 GPU	China	120,640	1.271	2.58
5	GSIC, Tokyo Institute of Technology	NEC/HP	<b>TSUBAME-2</b> HP ProLiant, Xeon 6C, NVidia, Linux/Windows	Japan	73,278	1.192	1.40
6	DOE/NNSA/LANL/SNL	Cray	<b>Cielo</b> Cray XE6, 8C 2.4 GHz	USA	142,272	1.110	3.98
7	NASA/Ames Research Center/NAS	SGI	<b>Pleiades</b> SGI Altix ICE 8200EX/8400EX	USA	111,104	1.088	4.10
8	DOE/SC/LBNL/NERSC	Cray	<b>Hopper</b> Cray XE6, 6C 2.1 GHz	USA	153,408	1.054	2.91
9	Commissariat a l'Energie Atomique (CEA)	Bull	<b>Tera 100</b> Bull bullx super-node S6010/S6030	France	138.368	1.050	4.59
10	DOE/NNSA/LANL	IBM	<b>Roadrunner</b> BladeCenter QS22/LS21	USA	122,400	1.042	2.34

# Performance Development

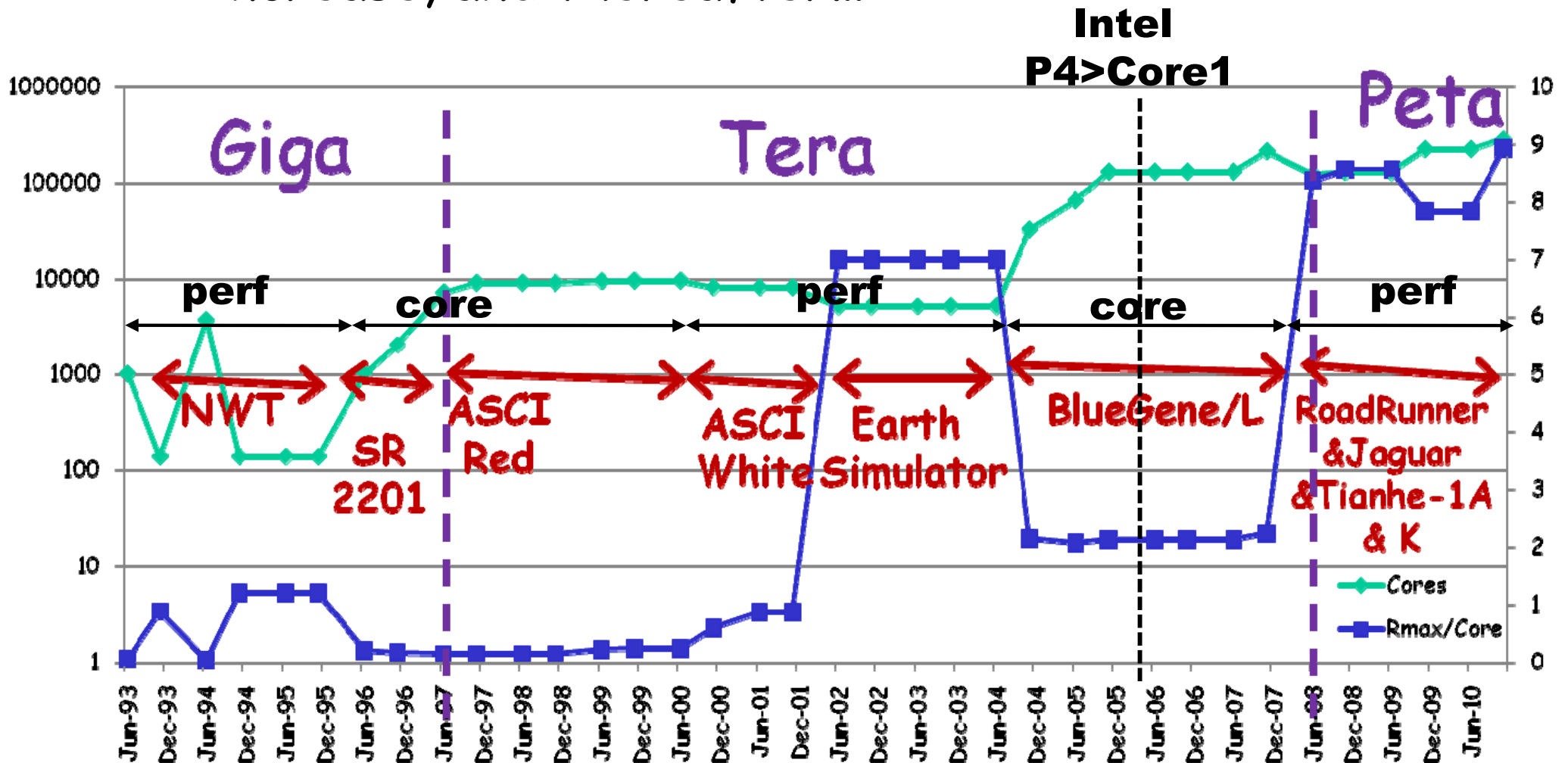


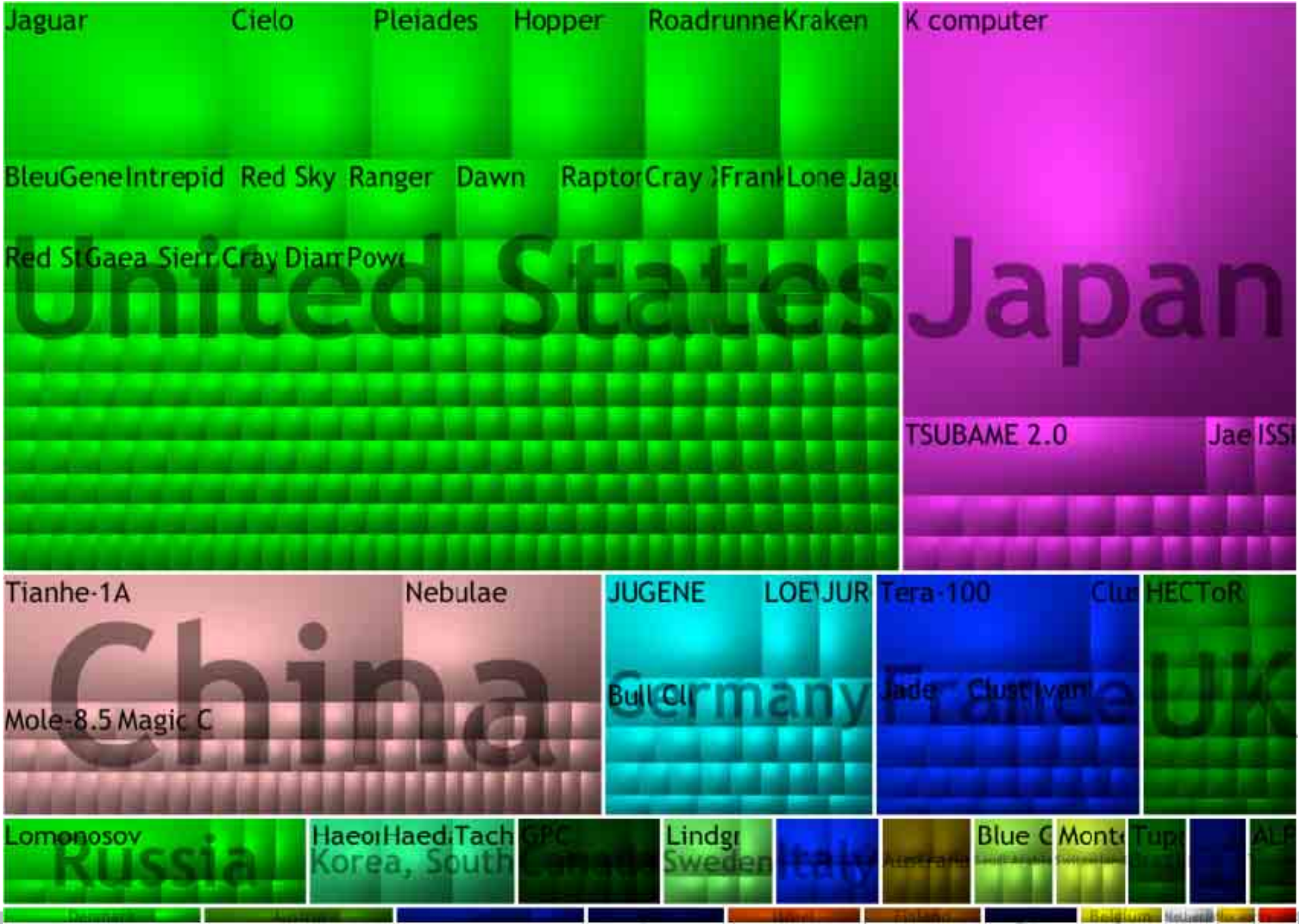
# Projected Performance Development



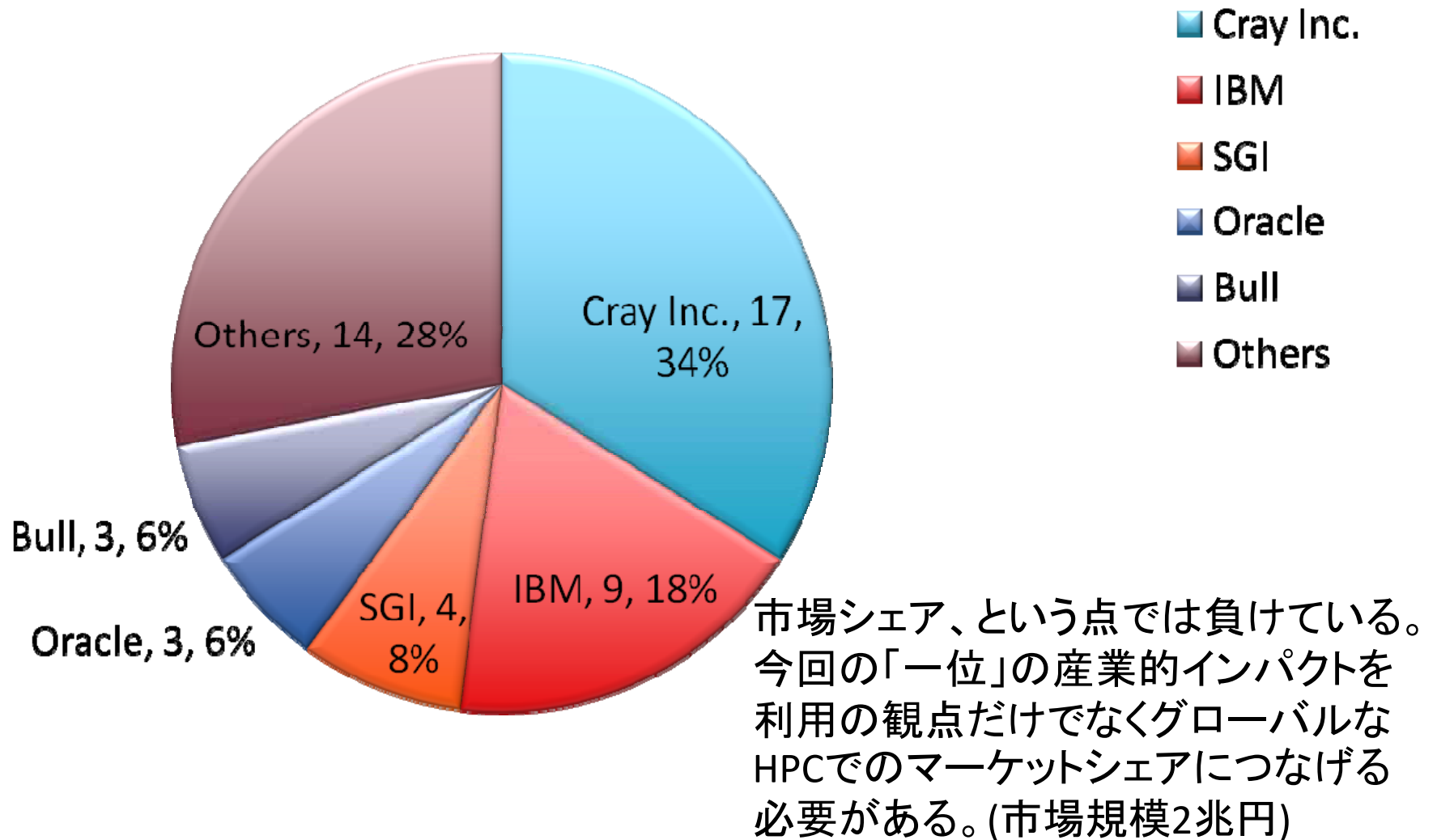
# #Cores & Rmax/Core on #1 Top500

- Alternating core increase vs. perf/core increase
- Next generation (10PF) will mainly be # core increase, and thereafter...

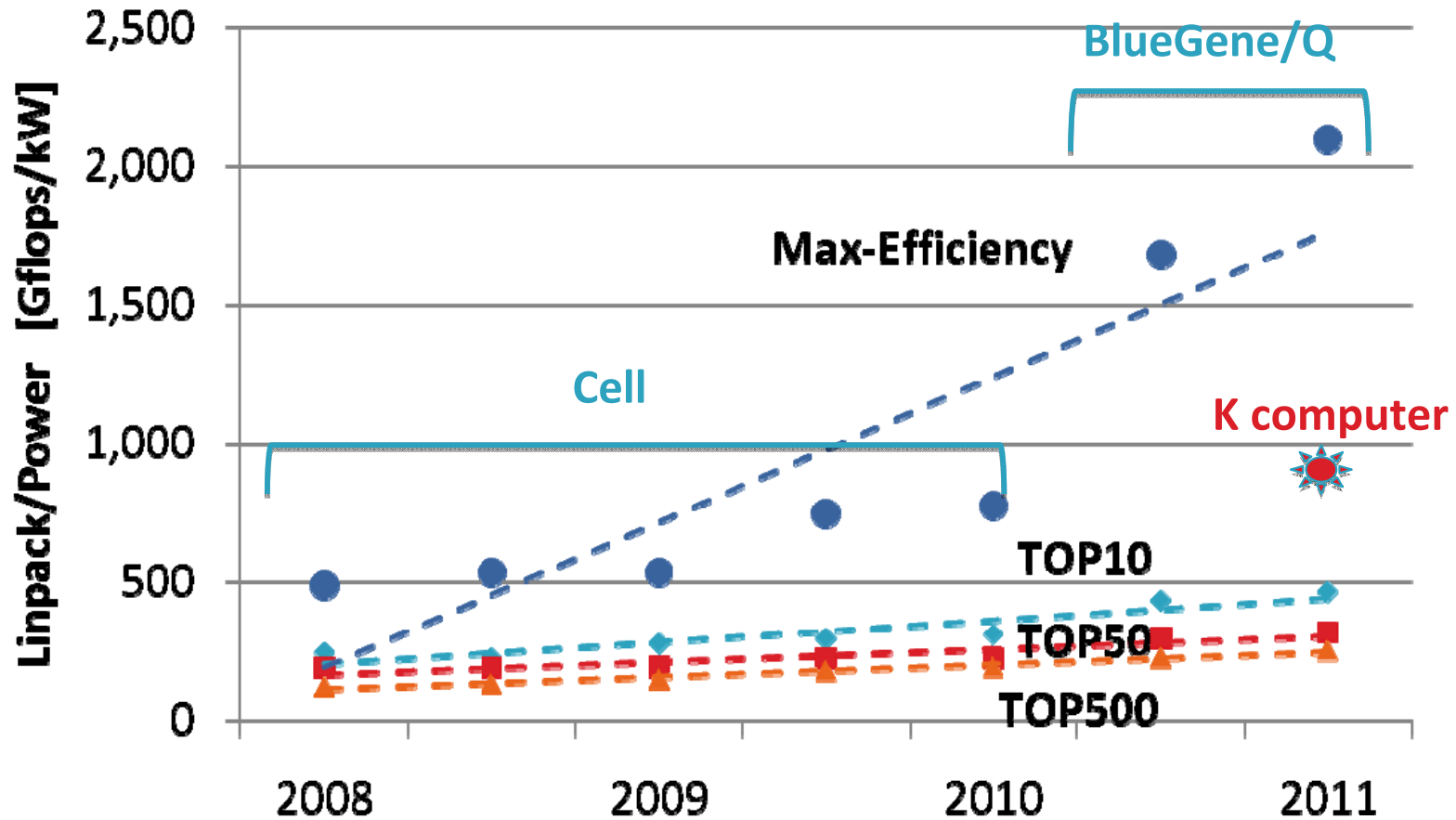




# Vendors (TOP50) / System Share



# Power Efficiency







# Asian HPC

Continents / Performance  
June 2011

- 16.6% (83) of Top500 systems are in Asia
- 4 machines in the Top 5 supercomputers

## – China

- Tianhe-1A (2<sup>nd</sup>) – 2.566 Pflops Rmax
- Nebulae (4<sup>th</sup>) – 1.271 Pflops Rmax

## – Japan

- Kei (1<sup>st</sup>) – 8.162 Pflops Rmax
- TSUBAME 2.0 (5<sup>th</sup>) – 1.192 Pflops Rmax

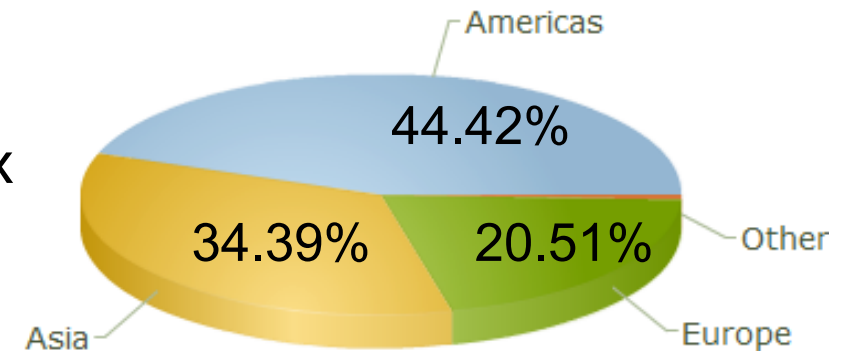
## – Saudi Arabia

- Shaheen (39<sup>th</sup>) – 190.90 Tflops Rmax

## – India

- EKA (58<sup>th</sup>) – 172.61 Tflops Rmax

- China's next Petaflops computer Dawning 6000 will use 10,000 of the Loongson series natively



# 京コンピュータは、スカラ型CPUを採用した超並列分散メモリ型スパコン



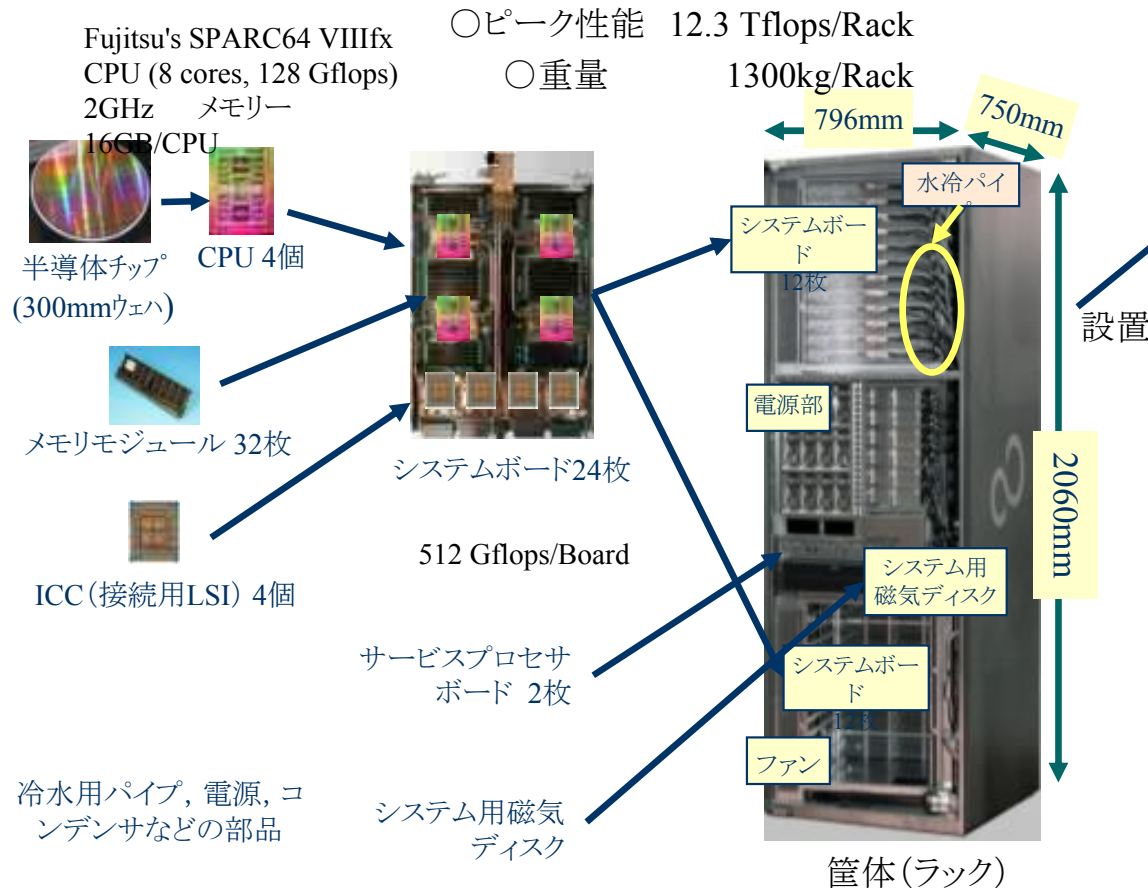
## 進捗状況(平成22年11月時点)

- 全体システムの0.5%を整備
- 平成22年11月のTOP500の発表において
  - Linpack性能: 170(48TFLOPS)
  - 電力効率: 4位(828MFLOPS/W)

## スケジュール

- 平成22年10月1日から、設置開始
- 平成23年 4月、システムの一部稼働
- 平成24年 6月、システム完成予定
- 平成24年11月、共用開始予定

## ○システムの構成と主要緒元



筐体数	800以上
計算ノード数(CPU数)	8万以上
コア数	64万以上
総メモリ量	1PB以上
ローカルファイル	11PB以上
グローバルファイル	30PB以上

# Remarkable Chinese HPC Growth



- China hosts the worlds fastest supercomputer Tianhae-1A
- From 3 – Top500 systems in 2001 to 41 – Top500 systems in 2011
- 2 Systems in the Top10 Nov. 2010
  - Tianhae-1A – 2.56 Pflops – 1<sup>st</sup> in Top500
  - Nebulae – 1.21 Pflops – 3<sup>rd</sup> in Top500
- Chinese Supercomputing efforts dominate Asia-Pacific region
  - Japan second with 26 systems in Top500
- Long term vision of Chinese HPC poised to challenge US dominance in the HPC space through the march to Exascale



# Tianhe-1A 2.566 Pflops Rmax



- 14,336 Xeon X5670 processors
  - 7168 NVIDIA TeslaM2050 GPUs
  - 4.04 MW
- 112 Cabinets, 12 storage, 6 communication and 8 I/O cabinets
- Custom designed proprietary high speed interconnects called runs at 160 Gbps
- Application domains: petroleum exploration, aircraft design
- \$88 million to build and \$20 million to operate

